Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com/journal/sjams/home

OPEN ACCESS

Obstetrics & Gynecology

Comparison of Ultrasonographic Score and Magnetic Resonance Imaging in Prediction of Adherent Placenta

Dr. Ankita Mathur*, Lata Rajoria, Aditi Bansal, Swati Gait
Dept. of Obstetrics and Gynecology, Zenana Hospital, SMS Medical College, Jaipur, Rajasthan, India

***Corresponding author:** Dr. Ankita Mathur
| **Received:** 01.01.2019 | **Accepted:** 10.01.2019 | **Published:** 21.01.2019
DOI: 10.36347/sjams.2019.v07i01.026

Abstract | **Original Research Article**

Background: The placenta accreta spectrum (PAS) is a complex obstetric complication and is a relatively new disorder of placentation. Early diagnosis and intervention in these conditions can more readily enable the obstetrician to minimize the risks to mother and fetus. The study intends to compare the diagnostic efficacy of an ultra-sonographic score i.e. Placenta Accreta Index Score (PAI score) with Medical Resonance Imaging (MRI) to predict adherent placenta in cases of placenta previa with previous caesarean. ***Methods:*** It was a prospective, non-invasive, observational study of 80 pregnant females presenting at or above 28 weeks of gestation with placenta previa and history of one or more prior caesarean in department of Obstetrics and Gynecology, SMS Medical College, Jaipur. Written informed consent was taken. After thorough history and examination, they underwent both ultrasonography to find out PAI score (published in AJOG-2014) and MRI. They were followed till pregnancy was terminated and their feto-maternal outcomes were analyzed. Diagnostic efficacy of both modalities were compared. ***Result:*** In our study, on plotting ROC curve, the AUC (Area under Curve) was found 0.958 with a cut off value of >2. The Sensitivity, Specificity, PPV and NPV of PAI score were found to be 92.86%, 94.74%, 95.10% and 92.30% respectively and Sensitivity, Specificity, PPV and NPV of MRI were found to 66.67%, 100%, 100% and 73.08% respectively. ***Conclusion:*** Ultrasonography using PAI score is better as compared to MRI in prediction of adherent placenta.
Keywords: PAI score, Placenta accreta, USG, MRI, Placenta previa.

INTRODUCTION

Placenta accreta is a clinical condition when part of the placenta or the entire placenta, invades and is inseparable from the uterine wall [1] and accounts for a large percentage of maternal morbidity and mortality due to hemorrhage as a major complication. There is a strong association between placenta previa, placenta accreta and prior caesarean section. Early diagnosis and intervention in these conditions can minimize the risks to mother and fetus. The current widespread use of imaging modalities in obstetrics has greatly advanced our ability to diagnose and manage placenta accreta. Considering the importance of prenatal diagnosis of abnormally invasive placenta, Rac MWF *et al*. [2], from Department of Obstetrics and Gynecology, University of Texas Southwestern Medical Center, Dallas derived the Placenta Accreta Index (PAI) score which is a 9 point score developed by doing mathematical calculation utilizing history of previous casarean section and placental location along with 4 highly correlated ultrasound indicators to improve the antenatal accuracy of accreta diagnosis (presence of multiple placental lacunae, progressive thinning or loss of the retro-placental hypoechoic zone, presence of anterior placenta previa and bridging vessels on colour Doppler study.

Table-1: Placenta accreta index* (American Journal of Obstetrics and Gynecology - October 2014)

Parameter	Value
1) 2 or more Casarean Deliveries	3.0
2) Lacunae**	
• Grade 2	1.0
• Grade 3	3.5
3) Sagittal Smallest Myometrial Thickness	
• <1 mm	1.0
• >1 mm to ≤3 mm	0.5
• >3 mm to ≤6 mm	1.0
4) Anterior Placenta Previa	1.0
5) Bridging Vessels	0.5

*If a parameter is absent then value will be 0 ** Lacunar grading (according to Finberg and Williams)[3]
0-none seen, 1-1 to 3 small lacunae, 2-4 to 6 large irregular lacunae, 3-multiple bizarre diffuse lacunae.

On T2 weighted MRI, placenta accreta presents with hyper-intense or heterogeneous mass, dark intra-placental bands, abnormal uterine bulging, adjacent organ invasion and focal interruption of the myometrial wall.

The learning objectives of this study to assess Placenta Accreta Index (PAI) Score among cases of Placenta Previa with prior caesarean delivery, to find out appropriate cut off of PAI Score for early diagnosis of Placenta Accreta and to compare the diagnostic efficacy PAI score and MRI to predict placenta accreta.

Materials and Methods

A hospital-based descriptive type of observational study was conducted prospectively in the Department of Obstetrics and Gynecology in collaboration with the Department of Radiology and Department of Pathology, SMS Medical College, Jaipur from April 2017 to November 2018 in which 80 pregnant females with period of gestation ≥28 weeks arriving at the antenatal clinic or presenting with bleeding PV, underwent transabdominal sonography (TAS). Pregnant women with multifetal gestation, known coagulation disorders and fetal distress requiring immediate emergency caesarean were excluded from the study. Thorough history, general, physical and obstetric examinations were performed. After taking a written informed consent to participate in the study, the pregnant female underwent MRI and ultrasonography to find out factors in favour of Placenta Accreta and to calculate the Placenta Accreta Index score. Follow-up was done till 37 weeks of gestation (asymptomatic) or till termination (symptomatic). Basis of confirmation of placenta accreta cases was histopathological report (HPR accreta). Findings were correlated and analysed statistically to find out an appropriate cut off value of PAI Score and diagnostic efficacy was compared with MRI.

Results

Table-2: Receiver Operator Characteristic Curve for Prediction of Placental Invasion Using Different Values of PAI Score

Criterion	Sensitivity	95% CI	Specificity	95% CI	+PV	95% CI	-PV	95% CI
≥0	100	91.0-100.0	0	0.0-8.6	48.7	37.4-60.2	-	-
>0	97.44	86.5-99.9	9.76	2.7-23.1	50.7	38.9-62.4	80	28.4-99.5
>1	97.44	86.5-99.9	58.54	42.1-73.7	69.1	55.2-80.9	96	79.6-99.9
>2	92.31	79.1-98.4	87.8	73.8-95.9	87.8	73.8-95.9	92.3	79.1-98.4
>3	79.49	63.5-90.7	90.24	76.9-97.3	88.6	73.3-96.8	82.2	67.9-92.0
>4	71.79	55.1-85.0	90.24	76.9-97.3	87.5	71.0-96.5	77.1	62.7-88.0
>5	61.54	44.6-76.6	92.68	80.1-98.5	88.9	70.8-97.6	71.7	57.7-83.2
>6	41.03	25.6-57.9	95.12	83.5-99.4	88.9	65.3-98.6	62.9	49.7-74.8
>7	38.46	23.4-55.4	95.12	83.5-99.4	88.2	63.6-98.5	61.9	48.8-73.9
>8	23.08	11.1-39.3	97.56	87.1-99.9	90	55.5-99.7	57.1	44.7-68.9
>9	0	0.0-9.0	100	91.4-100	-	-	51.2	39.8-62.6

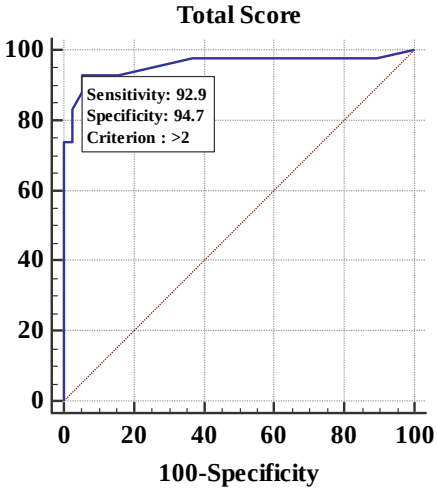

Fig-1

On plotting ROC (Receiver Operating Characteristic) curve for different values of PAI score to predict placenta accreta, the AUC (Area Under Curve) was found 0.958 in our study with a cut off value of >2 (value with maximum sensitivity and specificity).

Table-3: Diagnostic Efficacy of PAI Score and MRI

	HPR Accreta		Total	p-value	Kappa(K)
	Absent (n = 38)	Present (n = 42)			
A) PAI Score					
No	36 (45.00%)	3 (3.75%)	39 (48.75%)	<.0001	0.875
Yes	2 (2.50%)	39 (48.75%)	41 (51.25%)		
B) MRI Accreta					
No	38 (47.50%)	14 (17.50%)	52 (65.00%)	<.0001	0.655
Yes	0 (0.00%)	28 (35.00%)	28 (35.00%)		

Table-4: The K (kappa) value can be interpreted as follows

Value of K	Strength of Agreement
<0.20	Poor
0.21 - 0.40	Fair
0.41 - 0.60	Moderate
0.61 - 0.80	Good
0.81 - 1.00	Very good

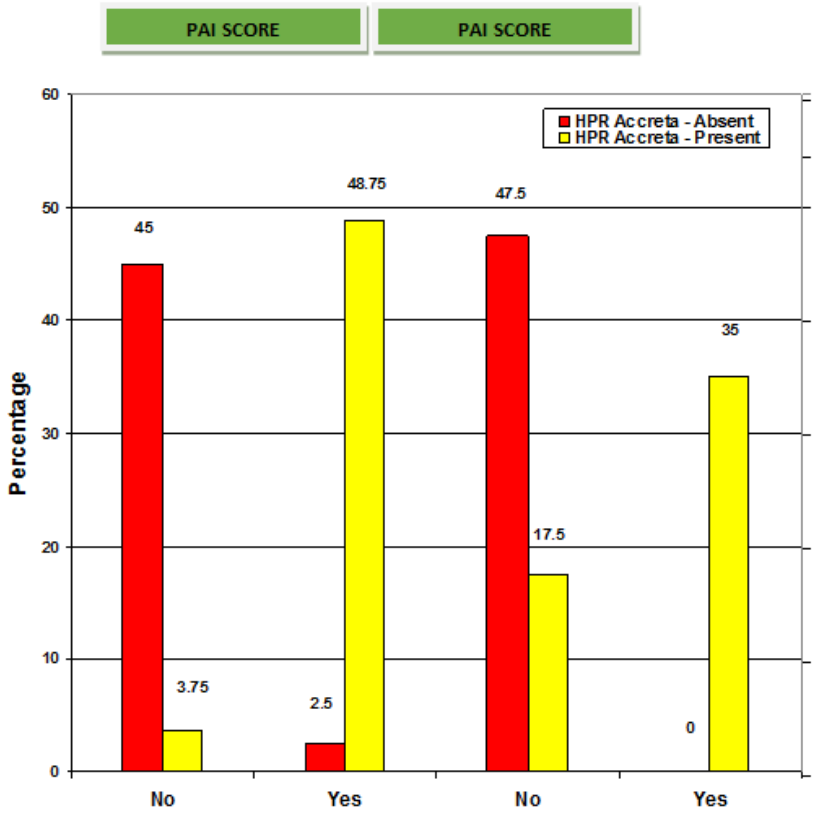

Fig-2

Using cut off value of 2, PAI score could predict 39 (92.86%) cases of placenta accreta out of 42 while 3 (7.14%) were missed in the diagnosis, which were confirmed later histopathologically. kappa obtained was 0.875, suggestive of very good Strength of Agreement (p-value 0.0001, significant).

MRI could detect 28 (66.67%) cases of placenta accreta while 14 (33.33%) were missed in diagnosis, which were further confirmed by Histopathology report as placenta accreta. kappa obtained was 0.65, suggestive of moderate Strength of Agreement (p-value 0.0001, significant).

Table-4: Comparison of Diagnostic Efficacy of PAI Score, Clinical Suspicion & MRI

HPR Accreta	Sensitivity (Sn)	Specificity (Sp)	Positive Predictive Value (PPV)	Negative Predictive Value (NPV)
PAI Score	92.86%	94.74%	95.12%	92.31%
95% CI	80.52% to 98.50 %	82.25% to 99.36 %	83.47% to 99.40%	79.13% to 98.38%
MRI Accreta	66.67%	100.00%	100.00%	73.08%
95% CI	50.45% to 80.43 %	90.75% to 100.00 %	87.66% to 100.00%	58.98% to 84.43%

CI: Confidence Interval

The Sensitivity, Specificity, PPV and NPV of PAI score were found to be 92.86%, 94.74%, 95.10% and 92.30% respectively and Sensitivity, Specificity, PPV and NPV of MRI were found to be 66.67%, 100%, 100% and 73.08% respectively.

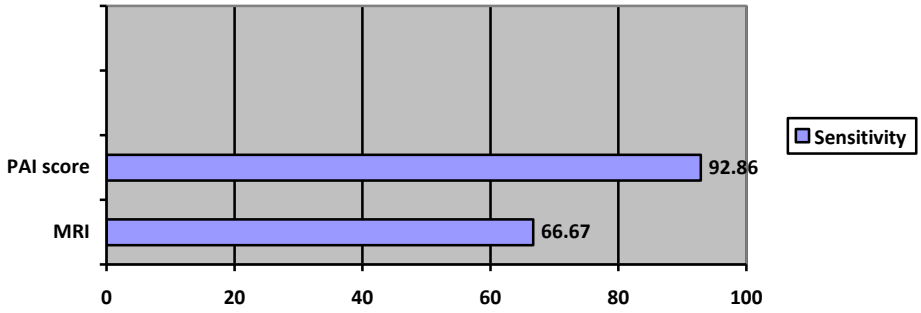

Fig-3

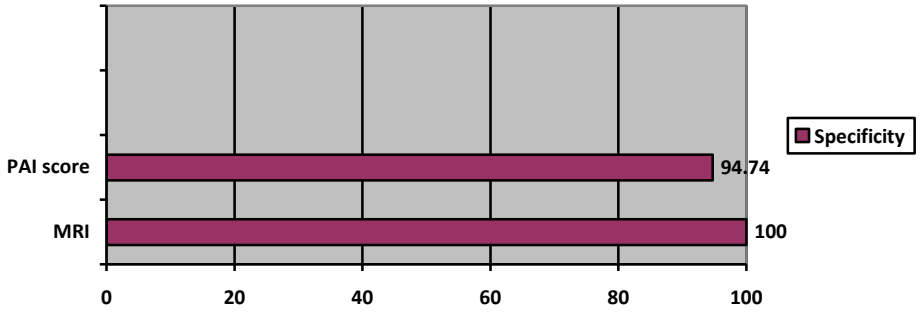

Fig-4

Table-5: Distribution of Cases According to Type of Placenta and Their Mean PAI Score

Total Score	Type of Placenta				p-value
	Placenta Previa (n = 38)	Accreta vera (n = 22)	Increta (n = 8)	Percreta (n = 12)	
Mean ± SD	0.94 ± 0.81	4.41 ± 2.29	7.44 ± 1.3	7.6 ± 2.17	<.0001
Median (IQR)	1 (0.250-1.250)	4.88 (2.500-6)	8 (6.625-8.250)	9 (5.625-9)	

IQR: Inter quartile Range; SD: standard deviation

In our study mean total score found in cases of placenta previa without invasion was 0.94 ± 0.81, accreta vera was 4.41 ± 2.29, increta was 7.44 ± 1.3 and percreta was 7.6 ± 2.17 respectively

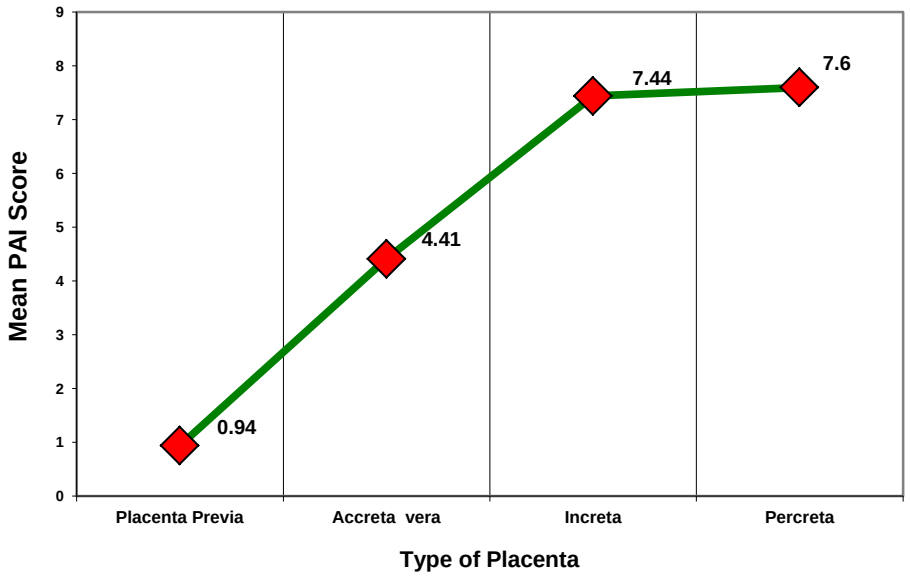

Fig-5

Table-6: Distribution of Cases According to Number of Prior Caesarean and Their Mean PAI Score

	Number of Prior Caesarean				p-value
	1 (n = 57)	2 (n = 17)	3 (n = 5)	4 (n = 1)	
Mean ± SD	1.89 ± 1.83	7.59 ± 1.93	7.8 ± 1.64	8 ± 0	<.0001
Median (IQR)	1.25 (0.250-2.500)	8 (7.562 - 9)	9 (6 - 9)	8 (8 - 8)	

In present study, mean total score was 1.89 ± 1.83 in case of 1 previous caesarean, 7.59 ± 1.73 in case of 2 previous caesarean, 7.8 ± 1.64 in case of 3 previous caesarean and 8 ± 0 in case of 4 previous caesarean.

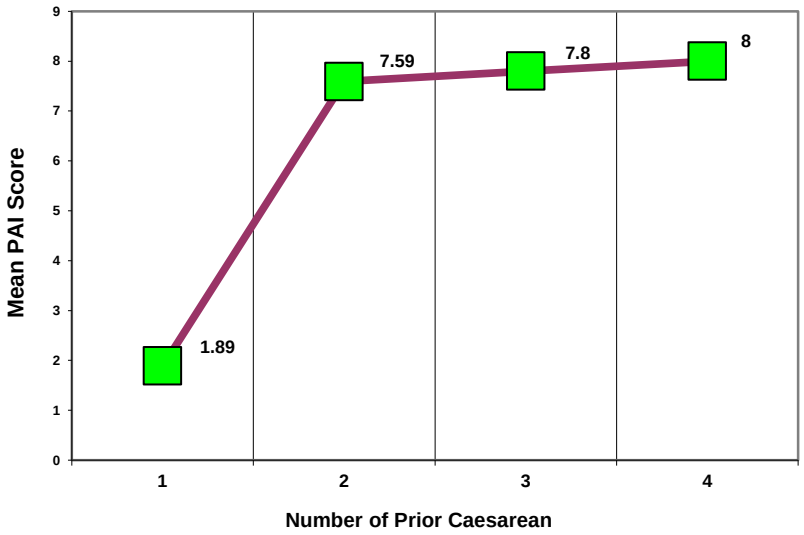

Fig-6

DISCUSSION

Martha WF Rac *et al.* [2] derived Placenta Accreta Index (PAI) and by plotting ROC curve, proposed the diagnostic accuracy at each score from 0 to 9. It was found that the probability of invasion increased with increasing value of score. No cut-off value of PAI score was given in the study.

In our study, on plotting ROC curve for each value of PAI score the AUC (Area Under Curve) was found 0.958 with a cut off value of >2. In study conducted by Samosir SM *et al.* [4] on cases with placenta accreta using PAI score, AUC was found to be 0.9 and a cut-off value of ≥3.125 was given for PAI score. In study conducted by Tripp Nelson *et al.* [5] on cases with placenta accreta using PAI score, AUC was found to be 0.794 and a cut off value of ≥4 was given for PAI score.

Table-7: Sensitivity, Specificity, PPV and NPV of Sonography versus MRI

Name of Study	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Our study				
Ultrasound	92.86	94.74	95.12	92.31
MRI	75.0	100	100	89.0
Satija B *et al.* [6]				
Ultrasound	87.5	86.4	70.0	95.0
MRI	66.67	77.3	54.0	73.08
Dwyer *et al.* [7]				
Sonography	93.0	71.0	74.0	92.0
MRI	80.0	65.0	67.0	79.0
Warshak *et al.* [8]				
Ultrasound	76.92	96.13	65.21	97.78
MRI	88.46	100.0	100.0	82.35
Masselli *et al.* [9]				
Ultrasound	91.0	100.0	100.0	100.0
MRI	100.0	100.0	100.0	100.0

In study conducted by Samosir SM *et al*. [4] on cases with placenta accreta, the Sensitivity, Specificity, PPV and NPV of PAI score were found to be 70%, 81.80%,77.8% and 75% respectively. In study conducted by Tripp Nelson *et al*. [5] on cases with placenta accreta, the Sensitivity, Specificity, PPV and NPV of PAI score were found to be 60%, 100%, 100% and 55% respectively.

Our study suggests that as the depth of invasion increases, the value of PAI score also increases and higher scores are predictive of severity of invasion. Results also concluded that occurrence of placenta accreta was associated with number of previous caesarean and as the number of previous caesarean increases, the value of PAI score also increases proportionately increasing the risk of placenta accreta.

CONCLUSION

On comparing the above methods of diagnosis, we conclude that PAI score (an Ultrasonograpy based score) is better than MRI to predict cases of placenta accreta. Lesser number of patients with placenta accreta are missed in diagnosis by PAI score as compared to MRI. PAI score provides an easily available and cost effective method of diagnosing placenta accreta and requires lesser experience and expertise. Using PAI score as predictive score will allow multidisciplinary planning and reduce overall morbidity and mortality associated with abnormally invasive placenta.

REFERENCES

1. Hughes EC, editor. Obstetric-gynecologic terminology: with section on neonatology and glossary on congenital anomalies. Philadelphia (PA): F.A. Davis. 1972.
2. Rac MWF, Dashe JS, Wells CE, Moschos E, McIntire DD, Twickler DM. Ultrasound predictors of placental invasion: the Placenta Accreta Index. Am J Obstet Gynecol. 2015 Mar; 212(3): 343.e1–7.
3. Finberg HJ, Williams JW. Placenta accreta: prospective sonographic diagnosis in patients with placenta previa and prior cesarean section. J Ultrasound Med. 1992 Jul; 11(7): 333-43.
4. Samosir SM, Irianti S, Tjahyadi D. Diagnostic tests of placenta accreta index score (PAIS) as supporting prenatal diagnosis and outcomes of maternal neonatal in abnormally invasive placenta management at general hospital of Hasan Sadikin Bandung. Int J Reprod Contracept Obstet Gynecol. 2017 Sep; 6(9): 3765-3769.
5. Nelson T, Chang E, Goodier C, Nino JM. Validation of the Placenta Accreta Index (PAI): Improving the antenatal diagnosis of the morbidly adherent placenta. AJOG. Jan 2017; S133.
6. Satija B, Kumar S, Wadhwa L, Gupta T, Kohli S, Chandoke R, Gupta P. Utility of ultrasound and magnetic resonance imaging in prenatal diagnosis of placenta accreta: A prospective study. Indian J Radiol Imaging. 2015 Oct-Dec; 25(4): 464-70.
7. Dwyer BK, Belogolovkin V, Tran L, Rao A, Carroll I, Barth R, Chitkara U. Prenatal diagnosis of placenta accreta: sonography or magnetic resonance imaging?. Journal of Ultrasound in Medicine. 2008 Sep;27(9):1275-81.
8. Warshak CR, Eskander R, Hull AD, Scioscia AL, Mattrey RF, Benirschke K, Resnik R. Accuracy of ultrasonography and magnetic resonance imaging in the diagnosis of placenta accreta. Obstetrics & Gynecology. 2006 Sep 1;108(3):573-81.
9. Masselli G, Brunelli R, Casciani E, Polettini E, Piccioni MG, Anceschi M, Gualdi G. Magnetic resonance imaging in the evaluation of placental adhesive disorders: correlation with color Doppler ultrasound. European radiology. 2008 Jun 1;18(6):1292-9.